TEXAS AGRICULTURAL EXPERIMENT STATION

B. YOUNGBLOOD, DIRECTOR

COLLEGE STATION, BRAZOS COUNTY, TEXAS

BULLETIN NO. 361 AUGUST, 1927

DIVISION OF ENTOMOLOGY

THE WORK OF THE STATE APICULTURAL RESEARCH LABORATORY 1919-1926

AGRICULTURAL AND MECHANICAL COLLEGE OF TEXAS

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†As of July 1, 1927.
*On leave.
**Dean, School of Veterinary Medicine.
***In cooperation with U. S. Department of Agriculture.
****In cooperation with the School of Agriculture.

SYNOPSIS

The State Apicultural Research Laboratory is a field station of the Texas Agricultural Experiment Station, Agricultural and Mechanical College of Texas. It is located twelve miles east of San Antonio near the geographical center of the beekeeping industry of the State. It was established to render aid, through scientific research, to the beekeepers in the solution of their problems. Experiments covering the investigation and improvement of bee pasture, the wintering of bees, and the improvement of bee stock, are in operation. A brief history of the Laboratory and a summary of the results of the experiments so far obtained are herein given. The extent of the distribution of tested queens of high quality with respect to honey production is shown. These queens were bred at the Laboratory in connection with experimental work and distributed at a nominal charge as they became available. Stimulation of interest in improvement of the strains of bees kept in Texas is expected to result from this policy.

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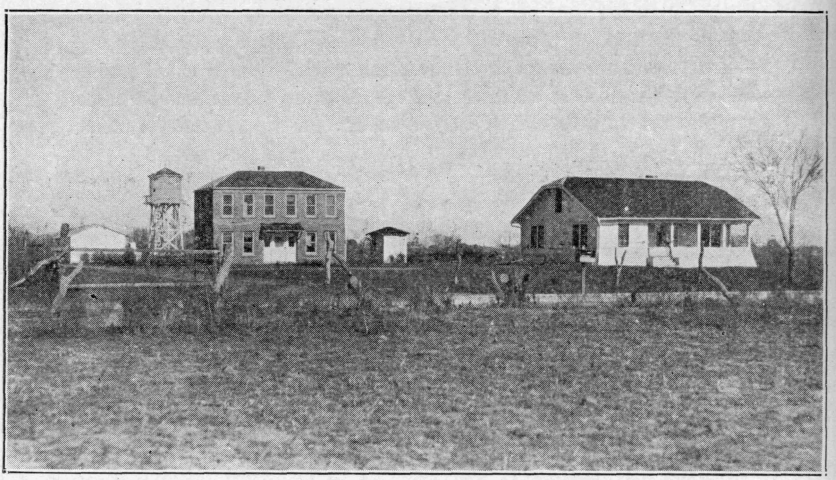

Figure 1
Laboratory and Apiculturist's Cottage

BULLETIN NO. 361 AUGUST, 1927

THE WORK OF THE STATE APICULTURAL RESEARCH LABORATORY, 1919-1926

H. B. PARKS

In recognition of the value of the beekeeping industry to the State, the Division of Entomology of the Texas Agricultural Experiment Station has placed considerable emphasis upon the importance of carrying on investigations to aid in solving the problems confronting the beekeepers. There have always been men connected with the Division who have been largely interested in bees, and bulletins on bee management, honey flora, bee enemies, and bee diseases have been issued as a result of their labor. Among the noteworthy investigations were the attempt at pure-line breeding at an isolated station on the Gulf Coastal Prairie northwest of Houston and the study of commercial honey production made in the Brazos Valley near College Station.

As a result of this activity the beekeepers, especially those with large commercial apiaries in Southwest Texas, having profited much by the work of the investigators at the Experiment Station and, desiring to have the apicultural investigational work increased, started a movement to obtain an appropriation to finance such work. The State Legislature in 1919 created the Experimental Apiaries by law and provided funds for their maintenance.

Work under this law began June 1, 1919, with the beekeeping equipment which had been accumulated by the Division of Entomology of the Texas Agricultural Experiment Station. The beekeepers of the State at one of the annual meetings of the Texas Beekeepers' Association suggested the problems to be investigated, and a project having three divisions was drawn up and approved. The investigations were outlined with reference to bee pasturage, winter management of bees, and racial improvement by means of well-bred, selected queens.

To find out anything definite relative to the honey flora, it was necessary to know the entire flora of the State. A floral survey of Texas was started in 1919. To solve the problems of winter management, bees must be studied during the winter in several parts of the State. A start was made toward this work October 15, 1919, by accepting from the Frio County Beekeepers an apiary at Dilley. In order to accomplish racial improvement by selection and the distribution of such selections, a queen yard was a necessity. One was established in Bexar County in 1920.

It was seen early by the Director and the Entomologist of the Texas Agricultural Experiment Station that the highly specialized experiments planned for the Experimental Apiaries demanded more room than could be had on the Entomology grounds at College Station and that a large field laboratory was needed. In order that such a Laboratory might have the advantages of a flora and a climate peculiarly adapted to beekeeping, a ten-acre tract of land was bought, in 1922,

near San Antonio. In the early fall a one-story brick building was erected to serve as office, laboratory and living quarters until other buildings could be erected. The period of 1922-26 has been one of construction work; at present, the Laboratory has reached a place where excellent work can be done and exact results obtained.

LOCATION

The State Apicultural Research Laboratory is located twelve miles east of San Antonio on the Hildebrand Road. The location is on the break between the Norfolk and Orangeburg fine sands. This break also marks the division between the lower Cretaceous and the upper Cretaceous formations.

As might be expected, this break is also a floral division line. On the west is the mesquite flora of the black land, and eastward the black-jack oak association of the sandy land. This place was chosen because of this double floral population. The altitude at the nearest United States Geological Survey bench mark, about one-fourth mile distant, is 667 feet.

WEATHER CONDITIONS

This station has not existed long enough for the collection of meteorological data on which to give usable averages, but the United States Weather Bureau Station, eleven miles west, has been in operation since 1884, and the following tables are made from the data of that station.

Table 1.—Normal precipitation and temperature at San Antonio, 1885-1926.*

Month	Precipitation, Inches	Temperature, Degrees F.
January	1.43	52.3
February	1.68	55.4
March	1.67	62.8
April	3.26	69.1
May	3.06	75.1
June	2.48	81.0
July	2.13	83.8
August	2.42	83.5
September	2.84	79.0
October	2.26	70.5
November	1.93	60.3
December	1.64	53.7
Annual	26.80	68.9

*Data taken from records of United States Weather Bureau.

The highest temperature occurring during the period 1885-1926 was 107 degrees F. recorded July 20, 1909; the lowest temperature for the period occurred on February 12, 1899, and was 4 degrees F.

The range in annual rainfall has been between a minimum of 10.11 inches in 1917 and a maximum of 50.30 inches in 1919. The greatest amount falling in 24 hours came October 1-2, 1913, when 7 inches was recorded.

Average date of last killing frost in spring, February 24.
Earliest date of last killing frost in spring, February 3, 1912.
Latest date of killing frost in spring, April 5, 1920.
Average date of first killing frost in autumn, November 28.
Earliest date of killing frost in autumn, October 30, 1917.
Latest date of first killing frost in autumn, December 31, 1923.
Average length of growing season, 276 10/13 days.
Longest growing period, 305 days, 1912.
Shortest growing period, 223 days, 1920.

CONSTRUCTION WORK

All will recognize that, without proper equipment and living facilities, effective research work cannot be attained. The building of such a plant was the first task of those in charge of this project. The small fund available and the limited personnel have caused this work to be greatly prolonged. The personnel consisted, the first year, of the Apiculturist in charge. In 1920 an assistant, giving one-half of his time, was added, and in 1924 this assistant was put on full time. A laborer was added to the force in 1925. This force of two technical men and one laborer have 10 acres of grounds and plats to care for as well as 350 colonies of bees under experiment and a queen yard which produces about 1000 queens yearly.

When the present land was purchased, it consisted of six acres of very badly eroded farm land and four acres of dense chaparral. As soon as a building was available, the experiments, begun at College Station, were resumed; as time and funds have allowed, the experiments have been increased in number and enlarged in scope.

The buildings have been erected in the following order: the first floor of the brick laboratory, well and windmill, scale house, cottage for Apiculturist in charge, garage and tool shed, laborer's cottage, water-tower and pipe system, Queen Breeder's cottage, and the second story of the laboratory building.

When it is known that the men in charge did most of this work in order that this most needed equipment might be had in the shortest time possible, it will be realized that the well improved land and complement of buildings represent no mean achievement.

EXPERIMENTAL WORK

Bee Pasturage

The source of most of the substances collected by bees is the native flora. A knowledge of this flora, especially of its geographical distrition, is of utmost value to the beekeeper. This not only helps him in locating his bee yards, but also in preparing for his year's work. The dimensions of the State are so great and the climate is so varied that honey production like crop production varies with locality. In fact, honey production varies to such an extent that at some point in the State there is a honey flow every month in the year. A reconnoissance survey and interviews with many beekeepers provided data for a map

of the distribution of honey plants and showed that these plants occur in eleven general districts. Each district is characterized by certain associations of plants having about the same soil requirements. In many places the boundaries of these districts are marked by several miles of overlapping floral associations, but as a rule the boundaries are very sharply marked. A comparison of this map with the soil map and geological map of the State shows the floral districts correspond

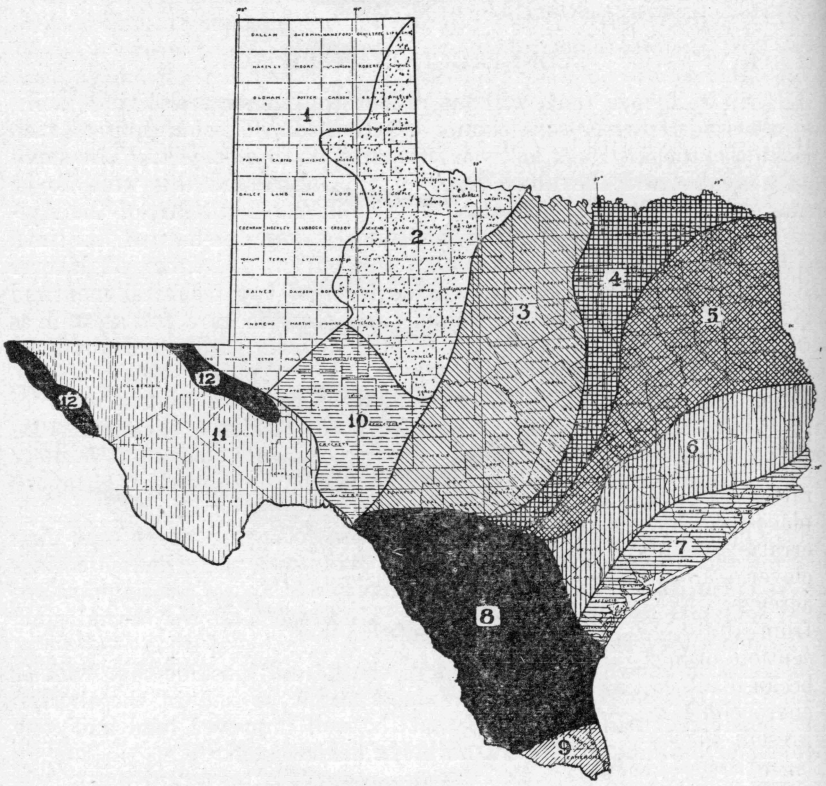

Figure 2.—Honey Plant Divisions of the State of Texas

1. Legume-Horsemint Association
2. Composite-Legumes Association
3. Sumac-Broom Weed Association
4. Cotton-Horsemint Association
5. Sweet Clover-Fruit Association
6. Rattan-Hardwood Association
7. Yaupon-Swamp Plants Association
8. Mesquite-Horsemint Association
9. Tropical Plant Association
10. Catclaw-Whitebrush Association
11. Catclaw-Desert Flora Association
12. Alfalfa-Sweet Clover Association

somewhat with the soil divisions, but more nearly with the geological outcrops. It is difficult to give names to any of these divisions that are entirely satisfactory to the various students interested. To make these locations known to the greatest number, the following tentative list of dual names is given. Where there is such a thing as an out-

standing honey plant in a division, the name of this plant becomes the name of the division.

Table 2.—Honey Plant Divisions of the State of Texas.

Common Name	Honey Plants
1. High Plains (Llano Estacado), Panhandle	Legume-Horsemint Association
2. Rolling Plains	Composite-Legumes Association
3. Limestone Hills and Prairies	Sumac-Broom Weed Association
4. Black Waxy Prairie Belt	Cotton-Horsemint Association
5. East Texas Rolling Timber Belt	Sweet Clover-Fruit Association
6. Flat Woods Belt	Rattan-Hardwood Association
7. Gulf Coast Prairie	Yaupon-Swamp Plants Association
8. Rio Grande Plain	Mesquite-Horsemint Association
9. The Lower Rio Grande Valley	Tropical Plant Association
10. Western Limestone Hills and Prairie	Catsclaw-Whitebrush Association
11. Trans Pecos Region Mountains and Plains	Catsclaw-Desert Flora Association
12. Irrigated Sections	Alfalfa-Sweet Clover Association

Heavy honey crops coming from a single species of plants are rare occurrences. Even in the cotton district where few other plants occur, there are still native honey plants which contribute to the crop. The honey is named after the plant which furnishes the characteristic flavor. The honey listed for sale by the Texas Honey Producers' Association is marked as to source. A compilation of the data gathered by the Honey Producers' Association shows the following list of honey plants in the order of the amount of honey produced: cotton 20 per cent; horsemint 19 per cent; mesquite 13 per cent; guajillo 4 per cent; catsclaw; cactus; broomweed; sumac; Mexican persimmon; yaupon; rattan; and whitebrush. Cotton and horesemint vie with each other for place in production. Some years mesquite ranks first, but it is an erratic producer. The cultivated plants,—cotton, alfalfa, and sweet clover,—are increasing in importance, owing to the ever-increasing acreage. No figures are available for the amount of honey produced from alfalfa or sweet clover in Texas. The wild plants, with the exception of mesquite and horsemint, are becoming of less importance because of the encroachment of cultivation upon their habitat. This encroachment has become so great that if beekeeping is to keep its present place among the Texas industries, nectar-yielding plants must be introduced or aided.

There is no known honey plant that will pay for its cultivation for honey alone. To meet the need for information as to the improvement of pasturage, the Laboratory has numerous tests on both native and foreign plants in operation. It will have a publication on the sweet clovers and crimson clover ready for distribution in a short time.

The Winter Care for Bees

Included under this division of the work are all of the experiments giving data on the relation and reaction of honey bees to all environmental factors. As the preparation for a successful wintering begins the first of August and the results of a successful wintering extends to that time, the solution of the wintering problem is but a perfect

understanding of the relationship of the bee to its surroundings. To obtain this information the Laboratory maintains a complete set of weather instruments. In addition to these and in order to keep an accurate check on the activity of bees, every change of weight that occurs in a colony is recorded by a time-weight machine. In addition, seven colonies on scales are weighed twice a day. Recording thermographs and hygrographs are used inside the hives. Much that is of value has already come to light. One of the most important things is the fact that the yearly life of a colony is divided into four periods of food consumption; namely, a fall-brood rearing period, a winter static period, a spring-brood rearing period, and a summer static period. The amount of food necessary to carry a normal average colony through these periods has been determined, and suggestions as to how to take advantage of this knowledge in caring for bees will be the subject of a publication.

The following interesting results also have been obtained. Bees stop all activities in the field when the temperature reaches 94 degrees F., the sky being clear, and the moisture in the air being less than 50 per cent. The lethal temperature for confined bees is near 120 degrees F. The temperature 6 inches under the ground at the Laboratory never goes below 60 degrees F. This makes the burying of colonies of bees for winter protection impractical, as the constant temperature of 60 degrees outside of the hive allows the bees to maintain a temperature within the hive sufficiently high to keep up brood rearing. This causes either the consumption of all the stores long before the first spring honey flow of the swarming of the colony while the above-ground temperature is too low for the bees to establish a new colony. Either condition generally results in the death of the colony.

In all of south and southwest Texas, winter packing is not necessary until spring-brood rearing is well advanced. When heavy packing is used no winter cluster is formed, with the result that stores are exhausted long before the spring honey flow or that swarming occurs before warm weather.

Light packing or a good windbreak is necessary in early spring. This is to prevent the chilling of the brood in the rapidly expanding brood nest.

Entrance-guards with a five bee-way opening should be put on all hives by November 20 as a prevention against mice and wind.

To pass the winter in the best shape, a 2-story, 10-frame standard hive should weigh, complete with bees and stores, not less than 85 pounds.

Improvement of Stock

Rearing queens for improving the stock was the first work started. At present the yard has a capacity of about 50 queens every 21 days. The primary object of the yard is to obtain data on the development of queens and on the improvement of stock by selection, cross breeding, or line breeding. The surplus queens from this work have been sold to the beekeepers of the State. The map, Figure 3, shows how extensive this distribution has been. The high quality of the strain

of these queens developed at the Laboratory is best shown by the demand coming from honey producers and the queen breeders of the State. The queen yard is not operated for the purpose of selling queens for profit, but if it had been so operated to full capacity, it could not have filled one-half the orders received, which shows the demand for better queens which this distribution has developed.

In this work it was found that all queens used, whether of foreign or American breeding, showed a mixed ancestry. Pure-line in-breeding gives a fixed strain. The selection of the best individuals in a line from a strain, for breeders, gives a slow but constant increase in the characteristics for which selection is made.

As a result of the work in queen rearing and the use of many methods, a system was developed which has been used to advantage. Information on the operation of this system is given in Circular 35 entitled "Suggestions on Queen Rearing."

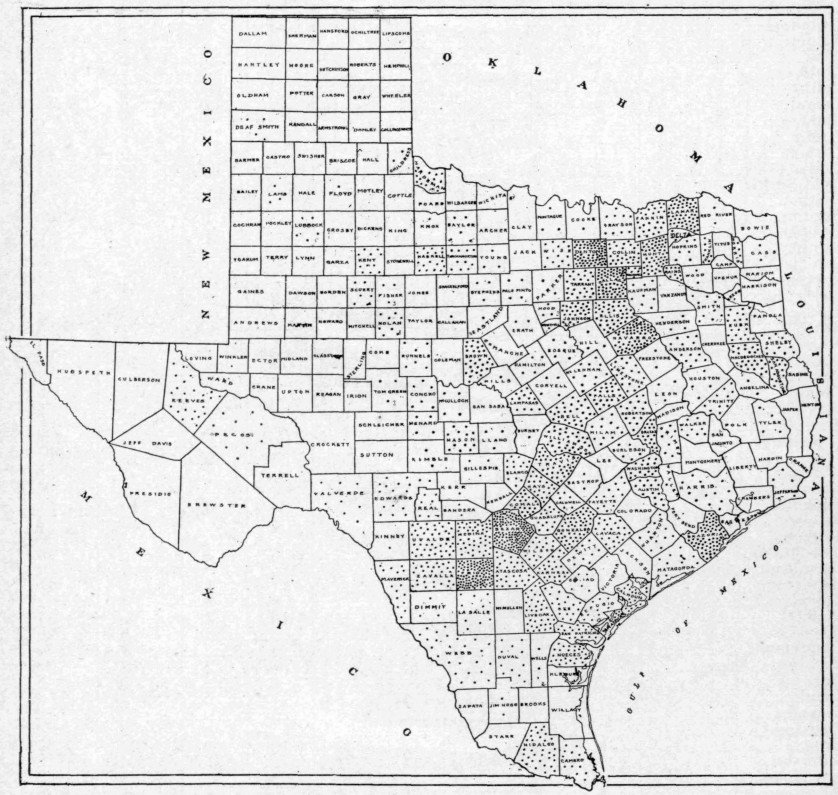

Fig. 3.—Map of Texas, each dot indicating that an improved queen has been supplied to a beekeeper in the county by the Apicultural Research Laboratory of the Texas Agricultural Experiment Station.

Table 3.—The number of queens distributed to Texas beekeepers, 1920-1926, shown by counties and the number of purchasers.

County	1920	1921	1922	1923	1924	1925	1926	No. Purchasers	Total
Anderson	10	1		1		1		7	13
Angelina						2		1	2
Aransas				11	1			2	12
Atascosa	3	5	4	7	6	7		10	32
Austin		3				10	1	3	14
Bandera					2			2	2
Bastrop						2		1	2
Baylor							5	1	5
Bee	4	5		5		1	2	9	17
Bell	4	8		1	10	5		12	28
Bexar	3	11	7	8	32	27	69	39	157
Blanco				3		11		3	14
Bosque		3		1				2	4
Brazoria	2			1	35	29		8	67
Brazos		9		7	3			6	19
Brown						12	17	6	29
Burleson	3					2		2	5
Burnet							1	1	1
Caldwell	3			3				2	6
Calhoun			2			5	2	3	9
Callahan							1	1	1
Cameron						12		1	12
Cass		2						1	2
Childress						2		1	2
Collin	4			6			18	6	28
Comal	3	1	4	3		7	4	9	22
Concho	6							2	6
Cooke		1						1	1
Coryell	1			3				2	4
Dallas	3	1		6	19		42	12	71
Deaf Smith						3		1	3
Delta		2						1	2
Denton				7	27	35	7	20	76
DeWitt		6		1			1	4	8
Dimmit	1			2				3	3
Duval				4			7	4	11
Eastland							1	1	1
Edwards	9	3	3			2		9	17
Ellis	12	1		6	14	7	1	15	41
Erath							2	1	2
Falls	7	3		2	5		7	9	24
Fannin	3		3			15	4	10	25
Fayette		1			1	5	6	5	13
Fisher	3							1	3
Floyd		1						1	1
Franklin							6	1	6
Freestone	2							2	2
Frio	3			7	33	33	39	18	115
Gillespie	3							1	3
Goliad	3			2				2	5
Gonzales	3			3	12	29	5	10	52
Grayson	3	1				5		3	9
Grimes				6				4	6
Guadalupe	3			6		5		5	14
Hamilton		4						2	4
Hardeman				10		1	2	5	13
Harris						9	3	4	12
Haskell					4	10	3	6	17
Hays	3			9			8	6	20
Henderson						4		1	4
Hidalgo	3		6	13		9	2	17	33
Hill	2					1		2	3
Hood		2		1				2	3
Hopkins		5				3		3	8
Houston							4	2	4
Hunt	8	8		18	6	10	7	23	57
Jefferson			3	1	1			4	5
Jim Hogg						2		2	2
Johnson	6	3		6		5	6	6	26
Jim Wells				2				2	2
Karnes		8	6		2	6		8	22
Kaufman				1		7		3	8
Kent				5	6			3	11

Table 3.—The number of queens distributed to Texas beekeepers, 1920-1926, shown by counties and the number of purchasers—Continued.

County	1920	1921	1922	1923	1924	1925	1926	No. Purchasers	Total
Kerr	1							1	1
Kimble						2		1	2
Kinney				1				1	1
Lamar	3	5			32		16	13	56
Lamb						3		1	3
Lampasas		9		3		1		5	13
La Salle		6		3				3	9
Lavaca	3		2	12		3	3	5	23
Leon		3						1	3
Limestone	7	3				5	2	6	17
Live Oak	25		3	1		7		17	36
Llano	3							1	3
Lubbock						5		1	5
McCulloch						4		2	4
McLennan				5		6		4	11
Mason						12		2	12
Matagorda	2					7		3	9
Maverick							15	1	15
Medina		4		10	15	19		16	48
Menard					2	2		2	4
Milam		3	1		6		1	5	11
Mills						1		1	1
Montague	3							1	3
Morris							4	1	4
Nacogdoches	6					20		7	26
Navarro		8	12	3	3	9	36	15	71
Nolan	2						6	3	8
Nueces	2			17		6		9	25
Palo Pinto						4		1	4
Parker	2							1	2
Pecos						9		2	9
Raines				3		4	2	7	9
Real		5		2				3	7
Red River		2						1	2
Reeves	3				5	15		3	23
Refugio				1		8		3	9
Robertson	1	3				11		4	15
Rockwall	3	3						2	6
Runnels				2	1		3	4	6
Rusk						2	18	3	20
San Augustine							12	1	12
San Patricio	6	9		1				6	16
Scurry						6		3	6
Shelby							12	1	12
Smith	5	2	1	2				6	10
Somervell							1	1	1
Stephens						3		1	3
Tarrant		3	4	2	15		1	9	25
Throckmorton				10				2	10
Tom Green	1			1			1	3	3
Travis	21	7	4	3	2		1	16	38
Trinity			1	1		7	1	8	10
Tyler	4							2	4
Uvalde	4	6	4	9	12	7		16	42
Valverde		3				5		2	8
Walker		6					2	2	8
Waller		1						1	1
Washington				5		5	5	4	15
Webb			1	3		21		6	25
Wharton		3	6			1		4	10
Williamson		3	3	12		6	7	7	31
Wilson				13		2	1	5	16
Wise		1				8	4	4	13
Wood				1	1			2	2
Young	3							1	3
Zavalla		10	2	7		9		9	28
Totals 139	236	206	82	311	313	586	437	672	2171

Total queens sent out, 2,171.
Total counties receiving queens, 139.
Total purchasers receiving queens, 672.

Regional Investigation

No. 1, Dilley Yard: This yard represents the conditions found in the Chaparral district and is located at the south edge of the city of Dilley. The original yard was a gift from the Frio County Beekeepers' Association. The yard now contains 50 colonies and is a representative commercial outyard in size and equipment. This yard was first used to obtain honey flow dates. Winter management and queen introduction experiments were carried on later. At present bee activity notes are being taken; 3 colonies on scales in the same yard provide information of changes occurring within the hive.

In this yard it was found that a 2-story, 10-frame hive could put out a 7-pound swarm. This swarm built 14 new combs and gave 75 pounds of surplus honey. The parent colony did not make the least gain in weight for 56 days and made no surplus honey.

Colonies requeened in August showed little tendency toward swarming. Such colonies produced one-third more surplus honey than colonies having 2-year-old queens.

A greater yield of honey can be made by taking the combs as soon as sealed rather than by waiting and taking the crop at the end of the honey flow.

Grease brush or Guayucan (Porlieria angustifolia) is a far better and more dependable honey plant than is generally supposed.

In connection with this yard, two commercial yards not belonging to the State are under observation in a beekeeping economics experiment.

No. 2, Roxton Yard: This yard is of commercial size and is located at Roxton in the sweet-clover-cotton section of northeastern Texas. This yard was established in 1923 with the aid of the Lamar County Beekeepers' Association.

Experiments conducted here show the value of moving bees from one locality to another to take advantage of local honey flows. The value of August requeening also showed itself in this yard.

Seguin Yard: This yard was put into operation in 1924 and a dual queen system put under test. This yard is to be used for the testing of bee behavior.

Substations: A few colonies of bees are kept on several of the Experiment Station Substations. The data taken by the men of the Substations give much information as to regional variations in honey crops and practice methods. The work done at the Substations at Chillicothe, Spur, and Lubbock shows that bees may be kept with profit in that region, which is as yet not counted as a beekeeping section.

PUBLICATIONS

The first publication of this Laboratory, Bulletin No. 255, Texas Agricultural Experiment Station, Agricultural and Mechanical College of Texas, entitled "Beekeeping for Beginners," was issued in December, 1919. The demand for this was such that the edition of 15,-

000 copies was distributed in eight months. As the demand did not abate, the bulletin was revised and reprinted in 1924.

Circular No. 35, Texas Agricultural Experiment Station, Agricultural and Mechanical College, "Suggestions on Queen Rearing" was distributed in February, 1925.

Many short popular articles from the Laboratory have been published in beekeeping and farm journals.

WHAT THE STATE APICULTURAL RESEARCH LABORATORY HAS ACCOMPLISHED

1. In four years' time, a piece of bare farm land and dense chaparral has been changed into a well-equipped, agricultural field laboratory.
2. Two thousand well-bred queens have been distributed.
3. A honey plant survey of the State has been made.
4. Forty thousand eight hundred pounds of honey have been produced.
5. One thousand eight hundred and thirty-six queens have been sold. The proceeds from the sale of the two above articles have been expended upon equipment for the Laboratory.
6. An outline of work for beginners in beekeeping has been perfected, Bulletin No. 255, Texas Agricultural Experiment Station, Agricultural and Mechanical College of Texas.
7. "Suggestions on Queen Rearing" has been published, Circular No. 35, Texas Agricultural Experiment Station, Agricultural and Mechanical College of Texas.
8. Thirty-five regular contributions of economic value have been made to bee journals.
9. Sixty articles relative to the care of bees have been published in farm papers.

SUMMARY

After selecting the site for the location of the State Apicultural Research Laboratory near San Antonio, four years ago, the work of clearing the land, constructing buildings, and assembling equipment has been carried on with the least possible interruption to the progress of the investigations.

A mass of notes and data has been gathered on the honey plants of Texas and this information is now being prepared for publication. If apiaries are located where only one or two surplus honey plants abound, it will pay to practice migratory beekeeping. The best locations for apiaries are along the boundaries of the floral divisions.

Information of the effect of temperature and humidity on the activity of bees has been gathered by weighing colonies with the aid of self-recording instruments. A study of this information shows that in all south and southwest Texas, winter packing is not necessary until spring brood rearing is well advanced. To pass the winter in the best shape, a two-story, ten-frame standard hive, complete with bees and stores, should weigh not less than 85 pounds.

The production of pedigreed queens, which have been selected and

bred with the object of improving the disposition and honey-gathering ability of the bees, has resulted in a slow but constant improvement along the lines for which selection was made.

Experiments on the manipulation of colonies show that when requeened in late summer, they seldom swarm the following spring. Such colonies on an average produce more honey than those having older queens.

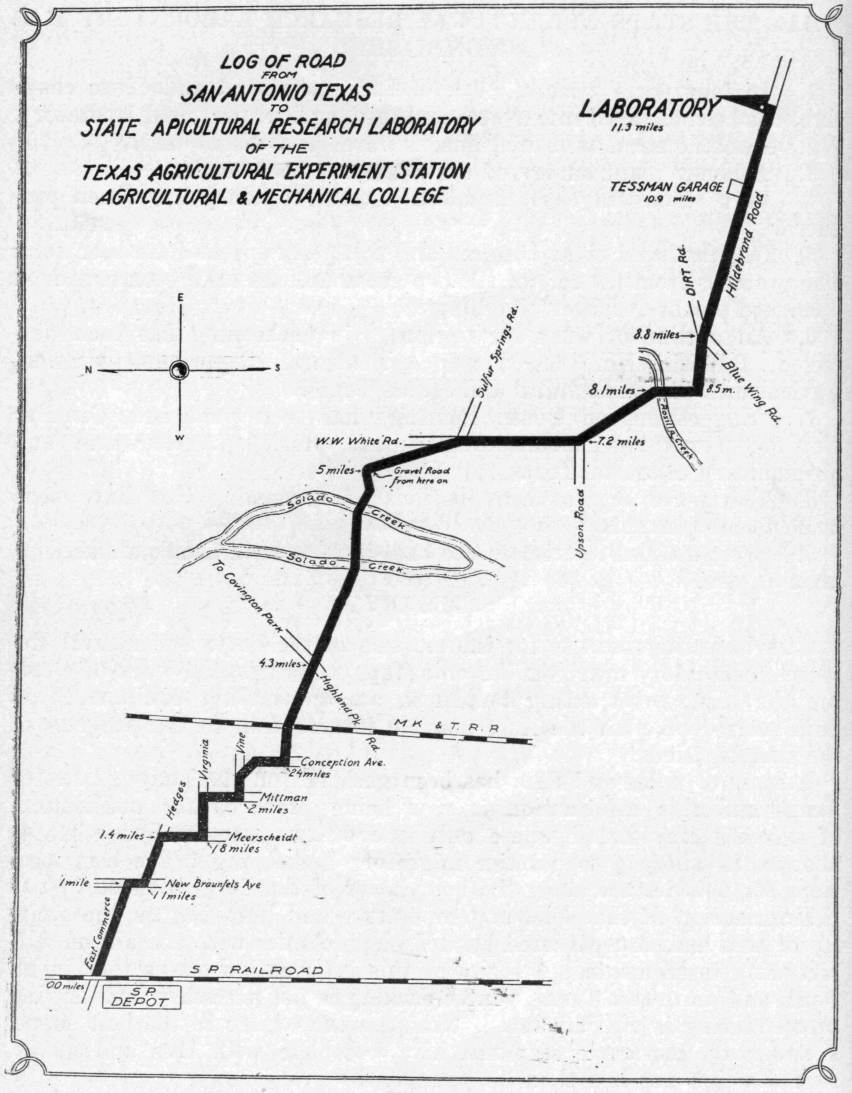

Figure 4